

CITY OF CARROLLTON WATER DISTRIBUTION SYSTEM SPECIFICATIONS

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Contacts: Mike Green (770-830-2023) – pre-construction meeting/inspections

Joe Kent (770-830-2021) – prior to charging water mains and testing

Article I. Scope

This specification covers the material requirements and installation procedures for all water pipe, structures, and appurtenances to be accepted into the City of Carrollton "City" water system. Any water pipe, structures, or appurtenances that the City has reason to believe is not in conformance with these specifications will not be accepted.

Article II. General

The contract drawings approved by the City, which shall be on-site at all times, indicate the extent and general arrangement of the water distribution system. If any departure from the approved contract drawings are deemed necessary by the contractor, details of such departures and the reasons therefore shall be submitted to the City as soon as practicable for approval. No such departures shall be made without the City's written approval.

All approved water distribution system plans and these specifications shall be considered as supplementary, one to the other, so that materials and labor indicated, called for, or implied by these specifications and not on the plans, shall be supplied and installed as though specifically called for on the plans.

No utility system shall be constructed, erected, altered, or repaired unless a certified utility manager or certified utility foreman who holds a current certification is present at the job site of such construction, erection, alteration, or repair of the utility system. Proof of such certification shall be provided to the City prior to the commencement of any utility work.

All contractors should be aware of the City's construction specification requirements prior to construction. The City will not be held responsible for any water distribution system installation, which cannot be accepted into its system because of the contractor's lack of knowledge of the existence of the City's specifications.

Article III. Quality of Workmanship and Materials

Section 301. Applicable Standards

The contractor shall supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), and American National Standards Institute (ANSI). Latest revisions of all standards are applicable.

Section 302. Warranty

Water distribution systems installed by contractors which are accepted by the City for ownership, operation, and maintenance shall be warranted and guaranteed for a period of two years from the date of the certificate of occupancy of the building to be served or for a subdivision the date of the recorded plat, whichever is applicable. Also, the developer/requestor shall make corrections due to any defects due to faulty products or workmanship upon notice by the City.

Article IV. Acceptable Materials

The contractor shall furnish all pipe fittings, valve tapping sleeves, hydrants, and all other material required for the completion of the work as shown on the approved drawings or indicated by these specifications. The contractor shall only furnish materials in accordance with the following:

Section 401. Pipe Materials

A. Ductile Iron Pipe: (6-inch diameter through 64-inch diameter):

Ductile iron pipe shall be a minimum of class 50 cement lined and conform to ANSI/AWWA C151/A21.51-91.

(Note: Where pipe provided is "pressure class", 350 psi class shall be substituted for class 50 DIP unless otherwise specified in the contract documents, project design, or design engineer). Fittings shall conform to AWWA C110 or AWWA C153 with minimum rated working pressure of 150 psi. Pipe and fittings shall be furnished with a bituminous outside coating.

Joints shall be push-on type for pipe and standard mechanical joints for fittings. Push-on mechanical joints shall conform to AWWA C111. Restrained joint pipe (RJP) shall be either the bolted joint type, or modified push-on type with joint restraint using ductile iron components. Restrained joint pipe where required shall be American, U.S. Pipe, or equal, as approved by the City.

The contractor is to provide the appropriate gaskets for mechanical or flange joints. Gaskets for flange joints shall be made of 1/8-inch thick cloth reinforced rubber; gaskets may be ring type or full face type.

The contractor is to provide the necessary bolts for mechanical or flange connections. Bolt or flange connections shall be steel with American regular finished square or hexagon heads. Nuts shall be steel with American Standard regular hexagonal dimensions, all as specified in AMSI B 17, 2, and AWWA C111. All bolts and all nuts shall be treated in accordance with ANSI B 1.1, Coarse Thread Series, Class 2A and 2B fit.

All pipe shall be furnished in lengths of at least 18 feet and fully gauged.

Material acceptance will be on the basis of the City's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

The minimum size of pipe for principal water mains and for water mains where fire hydrants are to be attached shall be 6-inch diameter.

B. Polyvinyl Chlorine Pipe (PVC Pipe) (2-inch only): PVC pipe material shall be a minimum of Class 200.

C. Copper Pipe and Fittings: (3/4-inch – 1-inch): Copper pipe shall be type "K" soft drawn copper water tube packed in coils, or cartons when specified. All service lines for subdivisions shall be 1" copper pipe and wyed into two 3/4"-inch taps. All other service shall be copper also.

D. Copper Pipe and Fittings: (3/4-inch – two-inch): Copper pipe shall be type "K" soft drawn copper water tube packed in coils, or cartons when specified. All service lines for subdivisions shall be 1" copper pipe and wyed into two 3/4"-inch taps. All other service shall be copper, also.

Section 402. Valves.

A. Gate valves with diameters 2 inches – 10 inches shall be resilient seat type conforming to the requirements of AWWA C509 with flanged, and mechanical joint ends. Valves shall be furnished with O-ring type stem seals. All valves shall open in a counter clockwise direction and close in a clockwise direction.

- B. Valves with diameter 12-inch and larger shall be butterfly-type conforming to AWWA Standard C504 with flanged, and mechanical joint ends.
- C. Buried valves shall be equipped with cast iron valve boxes. Extension stems will be provided where required.

Valves shall be manufactured by Mueller, M & H, or equal as approved by the City.

Valves shall be located on each water line immediately adjacent to each intersection of water mains and shall also be located as per direction from the City Engineer. Valves should be located at not more than one (1) block or 500 foot intervals in commercial districts and not more than one (1) block or 800 foot intervals in other districts. Where systems serve widely scattered customers, the valve spacing should not exceed 4000 feet. No valves shall be located in the pavement or curb and gutter.

Curbing shall be marked using an approved method of cutting the following symbols into the top of the curb. "W" Water Service, "X" Sewer Line, "V" Valve. Where no curbing exists, concrete valve markers shall be installed for each valve excluding fire hydrant valves and located at the back of the right-of-way. Curbing shall be installed prior to water main installation.

All Valves shall meet current AWWA Standards.

Section 403. Backflow Preventors.

The Contractor is responsible for installing the appropriate backflow preventers (as per site-plan approval) on commercial / industrial developments. For other information, please refer to the City of Carrollton's "Backflow Prevention Ordinance".

Section 404. Corporation and Curb Stops.

Corporation and curb stops shall be ball valve type, shall be made of bronze conforming to ASTM B 61 or B 62, and shall be suitable for the working pressure of 175 PSI or greater. Ends shall be suitable for compression type joint. Threaded ends for inlet and outlet of corporation stops shall conform to AWWA C 800; couplings not for connection to flared copper tubing shall conform to ANSI B 16.26. Corporation stops shall be manufactured by Hays, (Lee Brass) (5200 CF Mueller (H-15008) Ford (F10003G) and/or McDonald (4701BT) or approved by the Authority. Curb stops shall be manufactured by Hays (Lee Brass) (4302CFW), Mueller (B25170R), Ford (B41233WG) and/or McDonald (6102WT) or approved by the City.

Section 405. Valve Boxes (VB).

All valves shall be equipped with valve boxes. Valve boxes shall be heavy roadway type. The valve boxes shall be cast iron two-piece screw or slip type with drop covers. The valve boxes shall be adjustable up or down from the nominal required cover over the pipe. Typical valve box details are included in Appendix A. All valve boxes shall be manufactured by Higgins Foundry, U.S. Foundry, Tyler Pipe, Opelika or as approved by the City. See Figure 7A.

Section 406. Tapping Sleeves and Valves (TS & V).

Tapping sleeves, greater than two inches shall be of the split sleeve, mechanical joint type. Valves shall be gate valves furnished in accordance with the specifications shown above, with flanged connection to the tapping and sleeve and mechanical joint connection to the branch pipe. The necessary bolts, glands, and gaskets shall be furnished. Tapping sleeves and valves shall be cast iron or ductile iron. Full-circle tapping sleeves may be used on PVC and AC pipe.

Section 407. Tapping Saddles.

Tapping saddles up to two inches shall be ductile iron body with O-ring gasket and alloy steel double straps. Connection shall be threaded as required. Tapping saddles shall be manufactured by Smith Blair, Mueller, Ford, Dresser or equal as approved by WSA.

Section 408. Fire Hydrants (FH).

All fire hydrants shall conform to the requirements of AWWA C502 for 150 PSI working pressure and NFPA 1993 addition. Hydrants shall be the compression type, closing with line pressure. The valve opening shall not be less than 5 ¼ inches. All valves shall open counter clockwise.

In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above grade and in a manner which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.

The means for attaching the barrel to the standpipe shall permit facing the hydrant a minimum of eight different directions.

Hydrants shall be fully bronze mounted, with all working parts of bronze. Valve seat ring shall be bronze and shall screw into a bronze retainer.

All working parts, including the seat ring, shall be removable through the top without disturbing the barrel of the hydrant. The opening nut shall match those on the existing hydrants. The opening threads shall be totally enclosed in an operating chamber separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by a grease or oil reservoir.

Hydrant shall be a non-freezing design and be provided with a simple, positive, and automatic drain, which shall be fully closed whenever the main valve is opened.

Hose and pumper connections shall be threaded and pinned to seal them permanently to the hydrant barrel.

Each hydrant shall have two 2 ½ inch hose nozzle connections, (7.5 per inch) per National Standard Specs and one 4 ½ or 5 ¼ inch nominal size connection with National Standard threads (4 per inch). Each connection shall be equipped with cap and chain.

Hydrants shall be furnished with a mechanical joint shoe connection to the spigot of the six-inch hydrant lead.

Minimum depth of bury shall be 4.0 feet or as existing water main depths dictate. Provide extension section where necessary for vertical installations and in accordance with manufacturer's recommendations.

Hydrants shall be (A-423 Centurion Mueller), (M & H 129T) or equal.

Fire Hydrants shall be installed a minimum of 500 linear feet apart or as specified by the City Engineer on all mains greater than or equal to six (6) inches in diameter. The minimum line size for Fire Hydrants is six (6) inches in diameter.

Two (2) inch Flush Hydrants shall be installed at the end of all two (2) inch water mains for flushing purposes, including two (2) inch gate valve immediately prior to the aforementioned Flush Hydrant.

Section 409. Meter Boxes for 3/4 inch x 5/8 inch meters.

Meter boxes shall be manufactured in the United States and made from high density polyethylene. Meter boxes shall be 12 inches in height and bottom not less than 18 inches length x 13 inches width. Meter boxes shall be Ametek, Carson Brooks Plastic, Inc., or equal. Cast iron lids with short legs shall be supplied with each meter box.

All services shall be located as shown on the approved plans.

Section 410. Roadway Crossings

All roadway crossings shall be cased. All long-side taps shall be encased in 2" pvc pipe.

Article V. Material Inspection and Acceptance

Acceptance of all water pipe and appurtenances shall be on the basis of the City's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with all applicable standards.

Each pipe shall be clearly marked as required by the governing ASTM Standard Specifications to show its class, date of manufacture and the name and trademark of the manufacturer.

Latitudes in workmanship and finish allowed by the ASTM Specifications now with standing all pipe shall be first quality, have smooth exterior and interior surfaces and be free from cracks, blisters and other imperfections, and true to theoretical shapes and forms throughout each length. All pipe shall be subject to inspection by the City at the pipe plant, trench and other points of delivery for the purpose of culling and rejecting pipe, independent of laboratory tests, which does not conform shall be marked as such by the City and shall not be delivered or used in the work. On-the-job repairing of rejected pipe will not be permitted.

Any pipe or special items which have been broken, cracked or otherwise damaged before or after delivery or which have failed to meet the required tests, shall be removed from the site of the work and shall not be used therein.

Any pipe, solder or flux which is used in the installation or repair of the public water distribution system shall be lead free with not more than 8.0% lead in pipes and fittings and not more than 0.2% lead in solders and flux.

Article VI. Handling Materials

Section 601. Unloading.

The contractor shall furnish equipment and facilities for unloading, handling, distributing and storing pipe; fittings, valves and accessories. The contractor will have equipment available at all times for use in unloading. Any materials dropped or dumped will be subject to rejection by the City without additional justification.

Section 602. Handling.

The contractor will handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Pipe should be handled by rolling on skids, forklift, or front loader. The contractor shall not use material damaged in handling.

Section 603. Distribution.

The contractor shall distribute and place pipe and materials so as to not interfere with traffic. Pipe will not be strung more than 1,000 feet beyond the area where the pipe is being laid. Drainage ditches shall not be obstructed.

Section 604. Storage.

The contractor shall store all pipe which cannot be distributed along the route. The contractor shall make arrangements for the use of suitable storage areas.

Article VII. Clearing

The contractor shall clear all permanent easements before trenching. All trees, growth, debris, stumps and other objectionable matter shall be removed. Clearing of the construction easement is permitted, with special care taken to adhere to the requirements of Article XX. All unsuitable material shall be removed from the easement.

Article VIII. Excavation

The contractor shall excavate all materials encountered, including rock, and dispose of excess excavated material not required for backfilling. All excavation shall be performed in accordance with applicable local, state, and federal regulations, including the Occupational Safety and Health Act of 1970 (PL 91-596).

Section 801. Depth of Trenches.

The contractor shall excavated trenches to provide a minimum cover of three feet above the top of the pipe. Within the right-of-way of highways, streets, or roadways, the contractor shall excavate to place the top of the pipe a minimum of three feet below the nearest pavement edge.

Section 802. Width of Trenches.

Trenches shall be excavated wide enough to allow proper installation of pipe, fittings, and other materials and not less than six inches clear of the outside barrel of the pipe on any side at any point.

Section 803. Bell Holes.

At each joint, the contractor shall excavate bell holes of ample depth and width to permit the joint to be made properly and to relieve pipe bell of any load.

Section 804. Earth Excavation.

The contractor shall excavate and prepare the trench bottom to support the pipe uniformly throughout its length. For both ductile iron pipe and PVC pipe, the trench shall meet all requirements of Standard Laying Condition Type 2 in accordance with AWWA C151.

If the trench is excavated to excessive width or depth, as determined by the Inspector, the contractor shall provide a crushed stone bedding material meeting the requirements of Georgia DOT Specification 800.01 for No. 57 stone and bed the pipe to achieve Condition Type 4 in accordance with AWWA C151.

Section 805. Rock Excavation

- A. Definition of Rock: Any material which cannot be excavated with a backhoe having a bucket curling force rate not less than 18,300 pounds (Caterpillar Model 215 or equal) and occupying an original volume of at least ½ cubic yard shall be considered rock.
- B. Excavation: Where rock is encountered, the contractor shall excavate to the minimum depth and width which will provide six inches of clearance beyond the outside diameter of the pipe bell.
- C. Blasting: The contractor shall provide experienced workmen to perform blasting. All blasting operations shall be conducted in accordance with all existing ordinances and regulations. The contractor shall protect all structures from the effects of the blast and repair any resulting damage.
- D. Removal of Rock: The contractor shall not use excavated rock as backfill material. All rock which is surplus or not suitable for use as rip-rap shall be disposed of appropriately.

Article IX. Existing Underground Utilities and Obstructions

It is the responsibility of the contractor to locate all existing utilities along the path of his construction. His drawings shall indicate underground utilities or obstruction that are known to exist. Where these or unforeseen underground utilities are encountered, the location and alignment of the water main may be changed, upon written approval of the Authority, to avoid interference. It is the responsibility of the contractor to have all existing utilities located prior to any trenching operation. Any utility which may be injured in this operation will be at the expense of the contractor. Water/San. Sewer separation shall be 2' vertical and 10' horizontal (minimum).

Article X. Laying and Joining Pipe and Fittings

The contractor shall lay all pipe and fittings to accurately conform to the lines and grades as shown on the drawings previously approved by the City as follows:

Section 1001. Handling the Pipe.

The contractor shall lower pipe, fittings, valves and accessories into the trench by suitable means. The contractor shall not drop or dump pipe or accessories into the trench.

The Contractor shall clean pipe and fittings thoroughly with vegetable soap and water before laying. Care shall be taken to keep the pipeline clean until final acceptance.

If any pipe or other material is discovered to be defective or damaged after being laid, the contractor shall remove and replace it.

Section 1002. Alignment and Gradient.

The contractor shall lay pipe straight in alignment of gradient or follow true curves as nearly as practical. No joints shall be deflected more than the maximum deflection allowed by the manufacturer. The contractor shall maintain a transit and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

Section 1003. Expediting of Work.

The contractor shall excavate, lay the pipe, and backfill as closely together as possible. Unjointed pipe shall not be left in the trench overnight. The contractor shall backfill and compact the trench as soon as possible after laying and joining is completed. The exposed end of the installed pipe shall be covered each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe, the end shall be closed with a mechanical joint plug. However, backfilling shall commence only after inspection.

Section 1004. Laying Pipe in Trenches.

The contractor shall lay the pipe with solid bearing throughout its length.

- A. Earth Trenches: The bottom of the trench shall be graded to a true line. The pipe line shall be layed in clean bedding material, free of rock, organics, and other materials which, in the opinion of the inspector, are unsuitable.
- B. Rock Trenches: The pipe shall be bedded in at least six inches of granular bedding material. The contractor shall backfill with the same material to at least two feet above the pipe.
- C. Wet Trenches: Pipe shall not be layed in water. The contractor shall provide dewatering equipment to maintain a ground water level below the bottom of the pipe while pipe is being laid. Any damage which may result from the contractor's dewatering process is the responsibility of the contractor.

Section 1005. Jointing.

All joints shall be made in accordance with an applicable ASTM and AMSI/AWWA Standards.

Article XI. Connections to Existing Pipelines

Before laying pipe, the contractor shall locate the points of connection to existing pipelines and uncover them as necessary for the Authority to confirm the nature of the connection to be made. The contractor shall furnish all materials and make the connection to all existing pipelines. The contractor will be charged with a connection fee to cover the expenses of the City. All taps being made into existing pressurized lines shall only be made by experienced contractors with the City's inspection and using a method recommended by the DIPRA or the Uni-Bell Association.

Article XII. Thrust Restraint

The contractor shall provide a restraint at all points where hydraulic thrust may develop. See Figure 9 & 10.

Section 1201. Retainer Glands.

The contractor shall install eyebolts and rods on fire hydrants and all associated fittings, valves, and related piping. Retainer glands shall be equal to ACIPCO A 90875.

Section 1202. Concrete Blocking.

Concrete blocking shall be provided for all other bends, tees, valves, and other points where thrust may develop. Concrete shall have a compressive strength of not less than 3000 PSI and shall be precast. All concrete blocking shall conform to ASTM C94 and the reinforcing steel shall conform to the requirements of ASTM A615, Grade 40.

The contractor shall install concrete blocking at fittings as shown on the Typical Blocking Detail in Appendix A and as directed by the City. Blocking shall be directly against undisturbed earth.

Article XIII. Backfilling

The contractor shall backfill and compact the soil to prevent settlement and displacement of the pipe.

Section 1301. Suitable Material.

The contractor shall backfill trenches with earth only. Rock material excavated from trenches shall not be used in the backfill material. If necessary, the contractor shall furnish suitable earth material to backfill the trench.

Section 1302. Procedure for Initial Backfilling.

The contractor shall place backfill material in the bottom of the trench and up to two feet above the pipe in six-inch layers. The material shall be compacted in place one on each side and top of the pipe.

Final backfill shall be compacted as follows:

- A. In 12 inch layers if using tamping equipment such as a “mechanical tamp”.
- B. In two foot layers if using heavy tamping equipment.

Section 1303. Backfill Under Roads.

Backfill underlying pavement and backfill under dirt and gravel roads shall be compacted to 100% of the maximum dry density as determined by the Standard Proctor Compaction Test (ASTM D 698). Compaction test may be required in existing or proposed streets, sidewalks, drives, and other existing or proposed paved areas at varying depths and at intervals determined by the City Engineer with a maximum of one required test for each 400' of water main construction, unless soil conditions or construction practices in the opinion of the City Engineer warrants the need for additional tests.

Section 1304. Settlement.

If the trenches settle, the contractor shall refill and grade the top of the trench to conform to the adjacent surface.

Article XIV. Construction Along Highways, Streets and Roadway.

Section 1401. Conformance with Governmental Agencies.

The contractor shall comply with all construction operation requirements, safety requirements, traffic control requirements, road maintenance requirements and repair requirements of the City of Carrollton and/or the Georgia Department of Transportation while installing any water line and/or appurtenance along highways, streets and roadways.

Section 1402. Protection of Traffic.

The contractor is to provide and maintain suitable signs, barricades, and lights for protection of traffic as per MUTCD. All highway signs removed for construction shall be replaced at the end of each day. The contractor shall not close or block any highway, street, or roadway without first obtaining permission from the proper authorities. Experienced flagmen should be provided to direct and expedite the flow of traffic.

Section 1403. Construction Operations.

The contractor is to perform all work along highways, streets and roadways to minimize traffic interference.

- A. Stripping: Where the pipeline is laid along road shoulders, the contractor shall strip and stockpile all sod, topsoil, and other material suitable for shoulder restoration.
- B. Trenching, Laying and Backfilling: Trench excavation shall not be open cut any further ahead of pipe laying operations than is necessary. The contractor shall backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day. All lines shall be plugged at the end of each day.
- C. Shaping: The contractor shall reshape damaged slopes, side ditches and ditch lines immediately after completing backfilling operations. Topsoil, sod, and any other materials removed from shoulders shall be replaced.

Section 1404. Excavated Materials.

The contractor shall not place excavated material along highways, streets, and roadways in a manner which obstructs traffic. All scattered excavated material shall be swept off the pavement.

Article XV. Removing and Replacing Pavement

Section 1501. Removing Pavement.

The contractor shall remove existing pavement as necessary for installing the pipeline and appurtenances.

- A. Marking: Before removing any pavement, the contractor shall mark the pavement neatly paralleling the pipeline and existing street lines. The marks shall be spaced the width of the trench.
- B. Breaking: The contractor shall break the asphalt pavement along the marks using jack hammers or by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.
- C. Machine Pulling: No pavement shall be pulled with machines until it is completed, broken and separated from the pavement that is to remain.
- D. Damage to Adjacent Pavement: The contractor shall not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, the contractor is responsible for removing and replacing the damaged pavement.
- E. Sidewalks: Sidewalks shall be removed and replaced to their full width.
- F. Curbs: The contractor shall remove and replace or tunnel under any curb encountered.

Section 1502. Replacing Pavement.

Upon completion of the placing and consolidation of the backfill, the contractor shall arrange to have the compaction tested by an independent testing laboratory approved by the City. After the compaction testing has been satisfactorily completed and approved by the City Engineer, the contractor shall replace all pavement, sidewalks, and curbs that were removed.

Section 1503. Pavement Cuts.

Pavement cuts shall be backfilled with suitable material composed of natural or artificial mixtures of materials consisting of hard, durable particles of sand or stone, together with silt, clay and/or humus material for dry conditions and No. 5 stone for wet conditions and compacted to 100% of the maximum laboratory dry density. The top 8 inches of the pavement cut shall contain 6 inches of accelerated strength concrete which produces a compressive strength of 3000

psi within 24 hours and 2 inches of Cold Mix Asphalt for the top layer with a bituminous tack coat applied between layers Pavement.

Section 1504. Supervision and Approval of Pavement Restoration.

Pavement restoration shall meet the requirements of the regulatory agency responsible for the pavement. The contractor shall obtain agency approval of all pavement restorations before installing the final pavement. The contractor shall obtain the City's approval of pavement not the responsibility of a regulatory agency such as the City of Carrollton.

- A. Replacement: Prior to replacing the pavement, the contractor shall make a final cut in concrete pavement nine inches back from the edge of the trench. The contractor shall make the cut using a rotary saw. Asphalt pavement shall be removed nine inches back from the edge of the trench using jack hammers or other suitable tools. The contractor shall replace all street and roadway pavement as shown on the drawings. All driveways, sidewalks, and curbs shall be placed with the same material and to the same dimensions as existing.
- B. Failure of Pavement: Should any restoration or repairs fail or settle during construction or as per maintenance agreement, the contractor shall promptly restore or repair all defects.

Article XVI. Boring and Tunneling

The contractor shall furnish and install tunnel liner or pipe casing and install the pipeline therein in accordance with the following specifications.

Section 1601. Well Pointing.

The contractor shall operate well points or drainage systems in the vicinity of the tunnel or casing construction to prevent the accumulation of flood water in the tunnel or casing and to maintain the ground water table below the tunnel or casing invert.

Section 1602. Damage to Existing Structures.

The contractor shall take precautions to construct the tunnel so that no settlement of the overpassing roadway or railway section will occur. In order to prevent such settlement, the use of poling plates, breast boards, shields, and soil solidification or a combination of these methods may be necessary. The City shall not be responsible for any damage which may result from the tunnel construction.

Section 1603. Boring.

The contractor shall furnish all material and equipment and perform all labor required to install steel pipe casing at the locations indicated on the drawings. Boring design and materials shall be per all AREA, AASHTO, Georgia D.O.T., and other applicable standards.

- A. Material: Steel casing pipe shall be Schedule 30 steel pipe manufactured from steel conforming to ASTM A 139, Grade B. All casing size and thickness shall be as follows:

UNDER RAILROADS		
PIPE DIAMETER (inches)	CASING DIAMETER (inches)	WALL THICKNESS (inches)
2	4	0.330
4	8	0.330
6	12	0.330
8	16	0.375
10	16	0.375
12	16	0.375
14	24	0.562
16	36	0.625
18	36	0.625
20	36	0.625
24	36	0.625
30	40	0.625

UNDER HIGHWAYS		
PIPE DIAMETER (inches)	CASING DIAMETER (inches)	WALL THICKNESS (inches)
2	4	.330
4	8	0.330
6	12	0.330
8	16	0.375
10	16	0.375
12	16	0.375
14	24	0.562
16	36	0.625
18	36	0.625
20	36	0.625
24	36	0.625
30	40	0.625

The steel sleeves shall be painted inside and outside with two coats of bitumastic paint prior to delivery of the job site.

- B. Joint Usage of Casing Pipe: The contractor shall not install any pipe in a steel casing which is already carrying a pipeline without the written approval of the City.
- C. Installation of Casing Pipe: The contractor shall install the steel casing pipe by the dry boring method. The contractor shall bore the hole and install the casing through the soil simultaneously by a cutting head on a

continuous auger mounted inside the casing pipe to the preceding section in accordance with the AWS recommended procedures. After the boring and installation of the casing is complete, the contractor shall install a cleaning plug on the rig and clean the casing.

- D. Rock Formations: In the event that rock is encountered during the installation of the pipe casing which, in the opinion of the City, cannot be removed through the casing, the City shall direct the contractor to complete the crossing by installing a tunnel.

Section 1604. Tunneling.

The contractor shall install the tunnel liner in strict accordance with the Department of Transportation (DOT) and/or Railroad Company requirements. The contractor shall provide any special insurance coverage required by the governing body. The tunnel installer shall have a minimum of five years of experience in the construction of tunnels of a similar size. The contractor shall submit evidence of the installer's experience for review by the City.

- A. Blasting Permits: Prior to any work involving explosives the contractor shall make application to the D.O.T., or other appropriate agencies for a blasting permit. This permit will be in addition to any tunneling permit not involving explosives. The contractor shall comply with all requirements and conditions of the permits including required submittals.
- B. Traffic Control Requirements: The contractor shall schedule the work so as not to interfere with or in any way endanger traffic flow on the highway or railway. The contractor shall provide all required safety measures as specified in the Georgia Manual on Uniform Traffic Control Devices.
- C. Materials: Tunnel liner plates shall be manufactured from steel conforming with ASTM A569 with the following mechanical properties before cold forming:

Minimum tensile strength = 42,000 PSI

Minimum yield strength = 28,000 PSI

Elongation, two inches = 30%

Liner plates shall be 10 gauge, with the neutral axis diameter shown on the drawings for each crossing.

Minimum coatings required shall be galvanized in accordance with ASTM A 123 for liner plates and hot-dip galvanizing in accordance with ASTM A 307 for all other hardware. Additional protection required shall consist of a full bituminous coating meeting the requirements of AASHTO M 190.

All plates shall be punched for bolting on both longitudinal and circumferential seams or joints and shall be so fabricated as to permit complete erection from the inside of the tunnel.

The plates shall be equipped with two-inch standard pipe half-couplings welded into a hole in the center of the plate for grouting of voids occurring outside of the liner. Couplings shall be fitted with treaded cast-iron plugs. Bolts shall be no less than 5/8 inch diameter. Shop drawings showing details of the plates, size and length of bolts, and section modules in inches cubed per inch of width shall be furnished by the contractor for review by the Engineer, the City and Georgia D.O.T.

- D. Tunnel Construction Methods: After the tunnel has been completely constructed, the contractor shall thoroughly clean the interior and shall place structural quality concrete of a strength approved by the City within the invert of the tunnel. The contractor shall screen and trowel the top of the concrete to a smooth even surface at the exact level of the exterior of a pipe width placed to proper grade within the tunnel. As the pipe is jointed, it shall be drawn into position inside the tunnel.

Systems of standard pipe, fittings, hose, and special grouting outlets embedded in the liner plates shall be provided by the contractor. Care shall be taken to ensure that the parts of the system are maintained free from dirt. Grout composed of cement sand, and water shall be forced under pressure into the grouting connections. Grouting shall be started in the lower connections and shall proceed until grout begins to flow from upper connections. Connections shall then be made to these holes and the operation continued to completion.

Apparatus for mixing and placing grout shall be of a type approved by the Engineer and the Georgia D.O.T. and shall be capable of mixing effectively and stirring the grout and then forcing it into the grout connections in a continuous uninterrupted flow.

Liner plates shall be installed as soon as possible, but no more than five-feet of tunnel shall remain unlined while tunneling operations are in progress. Not more than one-foot of tunnel shall be left unlined at the end of the day's operation. The Contractor shall locate the liner plates with grout couplings at the top of the tunnel at intervals not to exceed five-feet. Additional plates with grout couplings shall be installed on each side of the tunnel between the top couplings.

After grouting is completed, pressure shall be maintained by means of stop cocks, or other suitable devices until the grout has set sufficiently. After the grout is set, grout holes shall be completely filled with dense concrete and finished neatly without evidence of voids or projections.

Section 1605. Installation of Pipe.

After the installation of the casing or tunnel is complete, the contractor shall install the pipeline by a method which has received prior approval of the designing engineer and the City.

- A. Pipe Closure: The contractor shall close the ends of the casing with four-inch brick walls, plastered with Portland Cement mortar. Brick and mortar shall meet the requirements for manhole materials.

Section 1606. Safety During Boring.

The contractor shall provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic at all times during the boring operation. All work shall be performed in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it. If, in the opinion of the City, the installation is being conducted in an unsafe manner, the contractor will be required to stop work and bulkhead the heading until suitable agreements are reached between the contractor and the City. The City will not be responsible and shall be saved harmless, in the event of delays to the contractor's work resulting from any cause whatsoever.

Section 1607. Safety During Tunneling.

The contractor shall begin the tunneling operation in a pit, sheeted and shored as necessary and being at and proceed from one end. The contractor shall observe all applicable requirements of all governing agencies and shall conduct the operations in such a manner that all work will be performed below the level of the roadbed. All work shall be coordinated and scheduled with all governing agencies. The contractor shall complete all tunneling work at one particular location before work is started at another location.

A temporary bulkhead against the face of the excavation shall be provided and placed during the cessation of work where the heading is 20-feet of railroad tracks or highway pavement.

If in the opinion of the City, the tunnel installation work is being conducted in a manner detrimental to the overpassing roadway or the safety of the traveling public, all operations of tunneling shall cease until the necessary corrections have been made. In the event that distress occurs to the roadway due to the tunneling operation, the contractor shall be required to submit a plan to repair the roadway. The plan must be acceptable to all governing agencies and the City.

Article XVII. Stream and Ditch Crossing

At all points where banks of streams or drainage ditches are disturbed by excavation or where natural vegetation is removed, the contractor shall carefully compact backfill and place rip-rap to prevent subsequent settlement and erosion.

This requirement applies equally to construction along the sides of a stream or drainage ditch, as well as the crossing of streams or drainage ditches. The Contractor shall place rip-rap a distance of not less than 10 feet upstream and 10 feet downstream from any disturbed area. Actual distance of rip-rap will be determined by the Inspector. Rip-rap shall be extended from one foot below the stream bed to the top of the bank and shall be placed to conform with the natural slope of the stream bank.

Section 1701. Rip-Rap Material Requirements.

The contractor shall use either stone rip-rap or sand-cement rip-rap throughout the job. The rip-rap shall meet the following material requirements:

- A. **Stone Rip-Rap:** Stone rip-rap shall be composed of sound, tough, durable stones resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. The stones' specific gravity shall be 2.0 or higher. The minimum weight of each individual stone shall be 50 pounds. The maximum allowable dimension for an individual stone shall be 24 inches. At least 50% of the stones shall have a minimum dimension of 12 inches.

The contractor shall imbed the stone rip-rap neatly so as to form a compact layer at least 12 inches thick. The rip-rap shall be placed in such a way that the smaller stones are not segregated, but evenly distributed. Chinking stones shall be placed in the crevices between the larger stones so that a dense, well grade mass is produced.

- B. **Sand-Cement Bag Rip-Rap:** Sand-cement bag rip-rap shall be composed of cement sacks or burlap bags having a capacity of from one to two cubic feet. Bags previously used for sugar or chemicals will not be acceptable. Bags shall be filled with a mixture of one part Portland Cement to five parts sand.

The contractor shall imbed the bags by hand to form a compact layer at least 12 inches thick. The bags shall be placed to form overlapping joints. The finished surface shall not deviate from that specifically by more than three inches at any point.

Article XVIII. Concrete Piers.

The contractor shall construct piers as shown on the approved drawings and in accordance with the following requirements:

Section 1801. Material.

Concrete shall have a compressive strength of no less than 3000 PSI , with not less than 5.5 bags of cement per cubic yard and a slump between three and five inches. For job-mixed concrete, the contractor shall submit the concrete mix design for approval by the City and the designing engineer. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 40.

Section 1802. Bearing on Earth Foundations.

Where excavation reveals undisturbed earth subsurface the piers shall be constructed with spread footing foundations.

Section 1803. Bearing on Rock Foundations.

Where excavation reveals level or benched rock having a minimum safe bearing value of 20,000 PSI, piers shall be constructed with foundations bearing directly on the rock. The contractor shall drill a minimum of four holes into the rock

under each pier, and grout dowels into place to anchor the pier to the rock. Hole and dowel sizes shall be in accordance with the requirements of the following table:

ANCHORAGE REQUIREMENTS FOR PIERS ON ROCK

CARRIER PAPER SIZE	GROUT HOLE DIAMETER (inches)	GROUT HOLE DEPTH (feet)	REINFORCING BAR DOWEL SIZE
8-24"	2.5	8	5
27-36"	4	8	6
42-48"	4	8	6
54"	4	8	6

The contractor shall grout holes from the bottom up using a grout pump. The contractor shall take extreme care to ensure that the entire hole is filled with grout prior to inserting the dowel.

Section 1804. Installation.

The contractor shall employ experienced formwork carpenters to construct all forms. Formwork shall be built sufficiently strong to resist lateral movement and distortion during pouring and to protect the pier from caving in.

- A. Dewatering: Before placing concrete, the contractor shall dewater the bottom of the hole and clean out all mud, loose earth, and extraneous matter.
- B. Pouring Concrete: The contractor shall pour concrete as soon as possible after the forms have been approved. Excavation shall not be left open for prolonged periods of time. Excavation shall be protected from surface water. The contractor shall not allow water to accumulate in the excavation or in the surrounding areas.
- C. Safety: The contractor shall take all necessary precautions to protect the work and personnel on the site. Open holes shall be covered when work is not in progress. All surrounding excavations and embankments shall be examined for all possible hazards.
- D. Inspection: The contractor shall select and, with the approval of the designing engineer and the City, employ a consulting soils and foundations engineer to perform the following:
 - 1. Inspect the bearing material and evaluate its suitability.
 - 2. Inspect the pneumatically drilled grout holes where applicable.
 - 3. Check the dimensions and plumbness of the forms to ensure conformity with the drawings and specifications.
 - 4. Evaluate the material penetrated by the excavation with regards to its lateral stability and uplift resistance.
 - 5. Recommend remedial measures should insufficient lateral stability or uplift resistance exist.

Article XIX. Testing and Acceptance

The City Engineer shall be given reasonable notice prior to work beginning and can be contacted at 770-830-2000. A pre-construction meeting with the developer, utility contractor, and the City of Carrollton shall be held prior to installation. The City reserves the right to continuously and/or periodically inspect construction methods to ensure compliance with these specifications. Unless other provisions have been specifically approved by the City, water lines and related facilities will be inspected and tested by the City before acceptance to the City's system are permitted.

Section 1901. Existing Valves.

The contractor shall not operate valves in the existing system without the specific authorization and direct supervision of the City.

Section 1902. Hydrostatic Tests.

- a. Pressure and leakage tests shall be performed in accordance with the latest edition of AWWA Standard C 600.
- b. The test pressure of the installed pipe shall be a minimum 1.5 times the working pressure, but not less than 150 psi, whichever is greater.
- c. Allowable leakage shall be no greater than as calculated in $L=SD(P)^{1/2}/133,200$ where L is allowable leakage in gallons/hour, S is the length of pipe tested in feet, D is pipe diameter in inches and P is test pressure during the leakage test in pounds per square inch (psi).

Section 1903. Disinfection Of Water Mains

The contractor shall disinfect all installed potable water lines and all other pipelines which may have been contaminated by the work. Sampling determinations of chlorine residual for sterilization and flushing shall be performed by the City's Water Quality Coordinator. The Water Quality Coordinator, Mr. Joe Kent, can be contacted at 770-830-2000.

- A. All New water mains, as well as those taken out of service for inspection, repair or other activities that might lead to contamination of water shall be disinfected before they are placed in or returned to service.
- B. Disinfection of the new mains and the disposal of the heavily chlorinated water following the disinfection, shall be accomplished in accordance with the latest edition of AWWA Standard C651.
- C. The "tablet method" of disinfection which consists of placing calcium hypochlorite granules or tablets in the water main as if is being installed and then filling the main with potable water when installation is complete in not
- D. Before the main is chlorinated, it shall be filled to eliminate air pockets and shall be flushed to remove particulates. A flushing velocity of not less than 2.5 feet/second is usually maintained in pipe sizes less than 24 inches in diameter. For larger diameter mains, an alternative to flushing, such as broom-sweeping of the main, is acceptable prior to chlorinating the main.
- E. During disinfection of the water mains, an appropriate cross-connection control device, consistent with the degree of hazard, shall be provided for backflow protection of the active distribution system.
- F. The quality of the water used during the disinfection procedures shall meet the required drinking water Standards.
- G. The chlorine solution used for disinfection of water mains shall have a free chlorine residual concentration not less than 25 mg/L. This heavily chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants shall be operated to ensure disinfection of the appurtenances. At the end of the 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10mg/L free chlorine. Re-chlorinate if required results are not obtained on all samples.
- H. After the applicable retention period, the heavily chlorinated water must not be disposed in a manner that will harm the environment. Neutralizing chemicals, such as Sulfur Dioxide, Sodium Bisulfite, Sodium Sulfite or Sodium Thiosulfate can be used to neutralize the chlorine residual remaining in the water to be wasted.
- I. Flush all lines until residual is equal to existing system. After final flushing and before the water main is placed into service, water samples shall be collected from the main and tested for microbiological quality in accordance with the Georgia Rules for Safe Drinking Water, Chapter 391-3-5. The laboratory results must show the absence of

coliform organisms in the water. Re-flush and re-disinfect the lines, as necessary, until satisfactory bacteriological results are obtained.

DISINFECTION WHEN CUTTING INTO OR REPAIRING EXISTING MAINS

- A. Shall be performed when mains are wholly or partially dewatered;
- B. Shall follow the current AWWA C651 Standards, including trench treatment, swabbing with Hypochlorite solution, flushing and/or slug chlorination as appropriate.
- C. Bacteriological testing shall be performed after the repairs are complete. However, depending upon the Circumstances, the water main may be returned to service prior to completion of testing to minimize the time the customers are out of service.
- D. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure may require no disinfection.

AMOUNT OF CHLORINE NECESSARY FOR DISINFECTION

- A. Chlorine required to produce 25 mg/L concentration in 100 feet of pipe by diameter:

Pipe Diameter (inches)	100% Chlorine		1% Chlorine Solution	
	(lbs)	(g)	(gal)	(L)
4	0.013	5.9	0.16	0.6
6	0.030	13.6	0.36	1.4
8	0.054	24.5	0.65	2.5
10	0.085	38.6	1.02	3.9
12	0.120	54.4	1.44	5.4
16	0.217	98.4	2.60	9.8

Note: 1% chlorine solution may be prepared with sodium hypochlorite(contains 5% to 15% available chlorine) or calcium hypochlorite (contains approximately 65% available chlorine by weight). To prepare 1% chlorine solution using calcium hypochlorite. Add one (1) pound (454 grams) of calcium hypochlorite in approximately 8 gallons of water.

- B. Amounts and types of chemicals advised to be used for neutralizing various residual chlorine concentration in 100,000 gallons of water.

Residual Chlorine Concentration Mg/L	Chemicals							
	Sulfur Dioxide (SO ₂)		Sodium Bisulfate (Na ₂ SO ₃)		Sodium Sulfite (Na ₂ SO ₃)		Sodium Thiosulfate (Na ₂ S ₂ O ₃ ·5H ₂ O)	
	lb	Kg	lb	Kg	lb	Kg	lb	Kg
1	0.8	0.36	1.2	0.54	1.4	0.64	1.2	0.54
2	1.7	0.77	2.5	1.13	2.9	1.32	2.4	1.09
10	8.3	3.76	12.5	5.67	14.6	6.62	12.0	5.44
50	41.7	18.91	62.6	28.39	73.0	33.11	60.0	27.22

Section 1904. As-Built Drawings.

As-built drawings are required to show all street names, right-of-way widths, related easements, lot numbers, location size, value locations, and material of all water mains and service lines and any related appurtenances.

Article XX. Protection and Restoration of Work Area

Section 2001. General.

The contractor shall return all items and all areas disturbed, directly or indirectly, by work under these specifications to their original condition or better as quickly as possible after work is started.

Section 2002. Restoration of Manmade Improvements.

The contractor shall protect or remove and replace, with the City's approval, all fences, piers, docks, walkways, mailboxes, pipelines, drain culverts, power and telephone lines and cables and other improvements that may be encountered in the work.

Section 2003. Cultivated Growth.

The contractor shall not disturb cultivated trees or shrubberies unless approved by the City. Any such trees or shrubberies which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.

Section 2004. Cutting of Trees.

The contractor shall not cut trees for the performance of the work except as absolutely necessary. Trees that shall remain in the work area shall be protected from damage from equipment. The contractor shall not store spoil from excavation against the trunks. The contractor shall remove excavated material stored over the root system of all trees within 30 days to allow proper natural watering of the root system. All damaged trees over three inches in diameter shall be repaired by an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, wood piles, or trash piles will be permitted on the work site.

Section 2005. Grassing.

The contractor shall replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Outside of developed areas, the contractor shall plant the entire area disturbed by the work in rye, fescue, bermuda or other suitable ground cover upon the completion of work in the area. In all areas, the contractor shall promptly re-establish successful strands of grass.

Section 2006. Erosion Control.

The contractor shall control erosion and sediment as per the City of Carrollton's Erosion and Sedimentation Control Ordinance.

Section 2007. Disposal of Rubbish.

The contractor shall dispose of materials cleaned and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate regulatory agencies, county, state, and federal.